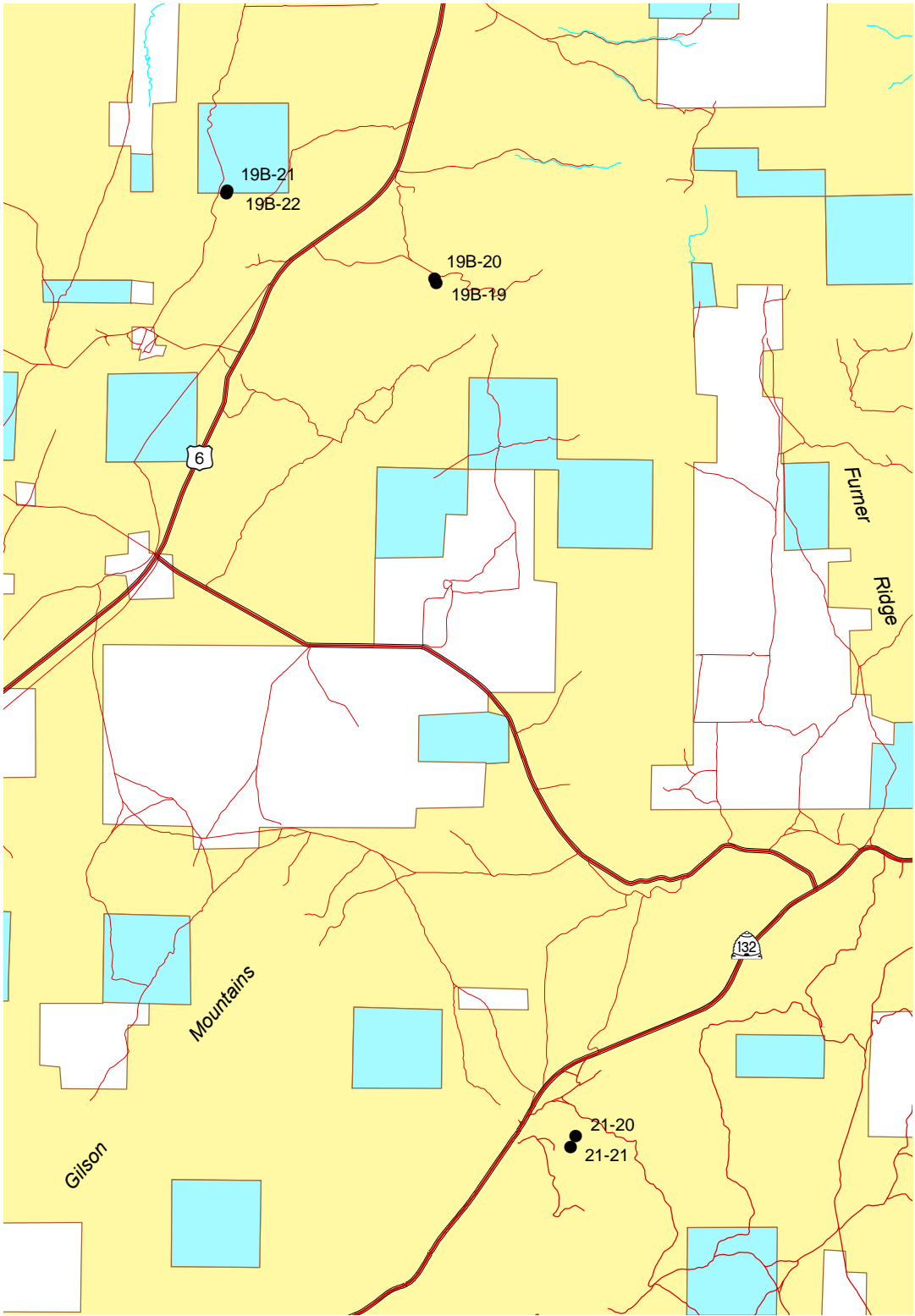


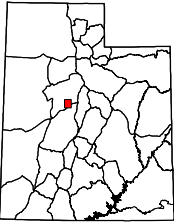
# Burn Rehab Treatment Area



Map Scale 1:115,249 (1 inch = 1.8 miles)

Map Location

- BLM
- State of Utah
- Private Land
- Water Body
- Major Road
- Minor Road
- Water Course



## Leamington Burn Complex Special Projects

### Introduction

In 1996, Utah experienced its most active, extensive, and devastating fire season in history. In Millard and Juab Counties alone, some 250,000 acres were burned. The Leamington complex was the largest burned area covering approximately 138,340 acres of mostly pinyon-juniper woodland. Rehabilitation efforts began in the fall of 1996 which included drilling the more accessible low-lying areas, with the remainder being aerially seeded and one-way chained to cover the seed and enhance establishment of the seeded species. On the Leamington complex, about 6,100 acres were treated with a rangeland drill, 10,736 acres were aerial seeded and one-way chained, and 8,308 acres were aerially seeded only. Aerially seeding and then chaining is an effective method of breaking up burned trees which provide valuable surface litter to help protect the soil from erosion and it enhances seed establishment by covering the seed. This practice was stopped temporarily because of concerns voiced by environmental and Native American groups with regard to archeological resources in the burned areas even though an archeological survey had been completed. During the summer of 1997, two study sites were established, Leamington burn and Leamington burn & chain. One was placed in a burned and seeded area, and the other established in the immediate area where it had been burned, seeded, then chained one-way. Two additional pairs of sites was established in 1998 at Paul Bunyan and near the Jericho sheep shearing sheds to monitor the same treatment effects as the Leamington sites. The purpose of these sites was to monitor the recovery of these areas following rehabilitation using seeding alone compared to seeding and chaining.

### Seed Lists

#### **Paul Bunyan Burn (19B-19) and Paul Bunyan Burn & Chain (19B-20)**

##### Aerial Mix

Species	Pounds of Seed	Pounds per acre
High Crest ( <i>Agropyron cristatum</i> )	15,100	4.0
Rye ( <i>Elymus junceus</i> )	11,350	3.0
Tall wheatgrass ( <i>Agropyron elongatum</i> )	7,500	2.0

##### Dribbler Mix

Fourwing saltbush ( <i>Atriplex canescens</i> )	3,800	1.0
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#### **Jericho State Section (19B-21)**

##### Aerial Mix

Species	Pounds per acre
High Crest ( <i>Agropyron cristatum</i> )	5
Intermediate Wheatgrass ( <i>Agropyron intermedium</i> )	3
Alfalfa ( <i>Medicago sativa</i> )	1
Yellow Sweet Clover ( <i>Melilotus officinalis</i> )	0.5

**Jericho BLM (19B-22)**

## Aerial Mix

Species	Pounds of Seed	Pounds per acre
High Crest ( <i>Agropyron cristatum</i> )	6,550	3.1
Rye ( <i>Elymus junceus</i> )	4,400	2.1
Tall wheatgrass ( <i>Agropyron elongatum</i> )	4,250	2.0
Smooth Brome ( <i>Bromus inermis</i> )	4,000	1.9

## Dribbler Mix

Fourwing saltbush ( <i>Atriplex canescens</i> )	2,150	1.0
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**Leamington Burn (21-20) and Leamington Burn & Chain (21-21)**

## Aerial Mix

Species	Pounds of seed	lbs/acre
High Crest ( <i>Agropyron cristatum</i> )	12,450	3.3
Rye ( <i>Elymus junceus</i> )	12,450	3.3
Tall wheatgrass ( <i>Agropyron elongatum</i> )	8,300	2.2
Great Basin Wildrye ( <i>Elymus cinereus</i> )	2,000	0.53
Smooth brome ( <i>Bromus inermis</i> )	600	0.16
Alfalfa ( <i>Medicago sativa</i> )	1,200	0.32
Small burnet ( <i>Sanguisorba minor</i> )	500	0.13

## Dribbler Mix

Fourwing saltbush ( <i>Atriplex canescens</i> )	3,700	1.0
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### Trend Study 19B-19-02

Study site name: Paul Bunyan Burn.

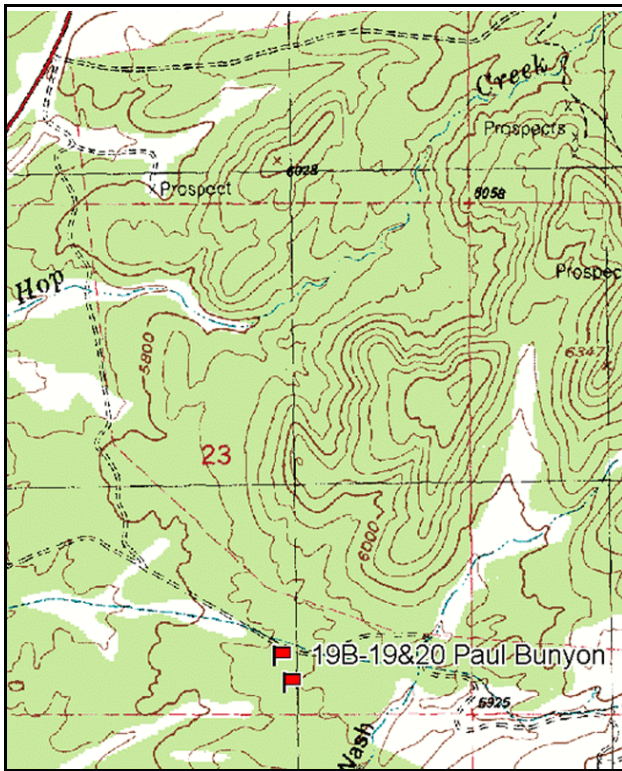
Vegetation type: Burn and Seeded.

Compass bearing: frequency baseline 68 degrees magnetic.

Frequency belt placement: line 1 (11ft), line 2 (34ft), line 3 (59ft), line 4 (71ft), line 5 (95ft). Rebar: belt 2 on 4ft.

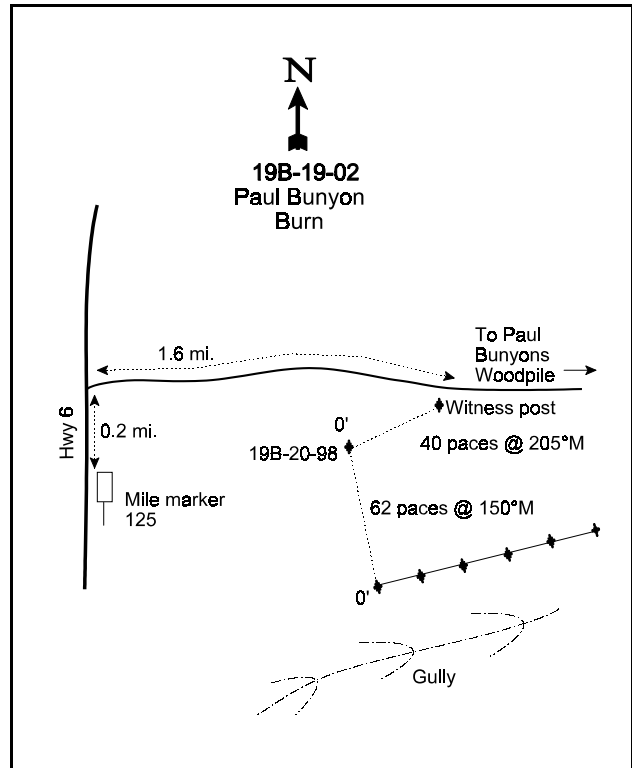
### LOCATION DESCRIPTION

From Hwy 6 go 0.2 miles north of mile marker 125. Turn right (east) heading toward the Paul Bunyan Woodpile. Drive 1.6 miles to a four foot tall witness post on the right side of the road. The 0-foot stake for study 19B-20 is 40 paces at 205degrees magnetic. The 0-foot stake for 19B-19 is 62 paces at 150 degrees magnetic from the other sites' 0-foot stake. The site is marked by short green fenceposts. The 0-foot stake is marked by browse tag # 66.



Map Name: McIntyre

Township 12S, Range 3W, Section 23



Diagrammatic Sketch

GPS: NAD 27, UTM 12S 4401335 N 401959 E

## DISCUSSION

### Paul Bunyan Burn - Trend Study No. 19B-19

This study was established in 1998 to monitor a burned and seeded pinyon-juniper area. This site, Paul Bunyan Burn, and the adjacent Paul Bunyan Burn and Chain site (19B-20) were part of the extensive Leamington burn complex which burned approximately 138,340 acres of mostly pinyon-juniper rangelands. Rehabilitation efforts were started during the fall of 1996. This included drilling, chaining, and seeding. This site samples a burned site that was aerielly seeded and not chained. A nearby burned area that was aerielly seeded then chained is sampled by study 19B-20 to contrast the difference between the two treatments. The Paul Bunyan Burn site has a west aspect with a gentle slope of 8 to 10%. Elevation is approximately 5,900 feet. Wildlife use this site only sparingly. Deer and elk pellets have been infrequent in all readings. A pellet group transect read on site in 2002 estimated 7 deer days use/acre (18 ddu/ha) and less than 1 cow day use/acre (2 cdu/ha). No elk pellets were sampled in the transect or in any quadrats in 2002. Rabbit droppings have been fairly common in all readings.

Soil at the site is moderately deep with an effective rooting depth estimated at 14 inches. Soil texture is a sandy clay loam with a neutral pH (7.0). Rock and pavement was abundant on the soil surface with a cover value estimated at 36% in 1999. Rock and pavement cover declined to 22% in 2002. Litter cover has steadily increased on the site with each reading from an initial estimate of 16% in 1998 to nearly 46% in 2002. Stoniness index data taken from penetrometer readings shows that most rocks are concentrated under the surface between 4-12 inches in depth. Due to the sandy texture of the soil, combined with high surface pavement cover, average soil temperature was high at 70°F at a depth of almost 16 inches in 1998. Bare soil was high at nearly 40% in 1998, but has steadily declined to 24% in 2002. It is most common under burned juniper trees where little vegetation of any kind is found. Some erosion is occurring on the site but it is localized and not severe. The erosion condition class was determined as stable in 2002.

Before the 1996 fire, this site was dominated by juniper trees. Point quarter data collected on dead trees estimated a density of 331 trees/acre in 1998. Following the fire, the browse component on this site is basically non-existent. A few plants of fourwing saltbush, bitterbrush, and ephedra occur scattered around the site, but none were sampled in the density strips in 2002. Use on the few plants that are present is heavy.

Perennial grasses are the key component in the vegetation community. Because this site was seeded, but not chained, perennial grasses have been slow to develop. The benefit of chaining is that it prepares the seedbed and increases the amount of safe sites wherein seeds can germinate and become established. Perennial grasses provided only 4% average cover in 1998 and 1999, but cover increased to nearly 12% by 2002. Introduced seeded species are the most abundant, these include crested wheatgrass and Russian wildrye. Native grasses are few but include bluebunch wheatgrass, Indian ricegrass, and bottlebrush squirreltail. Cheatgrass was the most abundant grass in cover and nested frequency in 1998 and 1999. It provided 76% and 82% of the total grass cover in 1998 and 1999 respectively. Cover declined in 2002 to less than 4%, which represented only 23% of the total grass cover in 2002. Nested frequency of cheatgrass significantly increased between 1998 and 1999, but significantly decreased in 2002 with. The decline in cheatgrass cover and frequency in 2002 is due mostly to drought conditions. Grasses have been vigorous with some of the seeded species growing to a height of three feet.

Forbs are lacking, especially perennial species. Sum of nested frequency for perennial forbs has steadily decreased since the first reading. Annual forbs were moderately abundant in 2002 with pale alyssum, tumble mustard, and Russian thistle being the most abundant. No forbs were included in the aerial seed mix due to planned future spraying of the site to control noxious weeds. Mormon crickets were noted to have utilized forbs in 2002.

## 1998 APPARENT TREND ASSESSMENT

There is a considerable amount of bare soil on the site, but erosion does not appear to be a problem. The lack of slope plays a large role in decreased erosion on this site. The soil trend will likely improve as more herbaceous vegetation becomes established in the future. There is little browse on the site. The few fourwing saltbush encountered appear to be well established. The herbaceous understory is well established, but cheatgrass is dominant and provides 76% of the grass cover and 60% of the herbaceous cover. All of the seeded grasses contained in the seed mix are found on the site, however only crested wheatgrass and Russian wildrye occur more than occasionally. The native grasses, Indian ricegrass and bottlebrush squirreltail, are also present but rare. They were likely depleted prior to the fire due to the high juniper tree density (331 trees/acre). Forb composition is poor with weedy biennial and annual species providing most of the cover. This condition will likely improve in time.

## 2002 TREND ASSESSMENT

Trend for soil is slightly up. Litter cover continues to increase, while bare ground continues to decline. Erosion remains minimal. Because of the lack of browse on this site following the burn, there really is not a browse trend. There are a few fourwing saltbush, bitterbrush, and ephedra throughout the area, but they were not sampled in the density strips in 2002. The herbaceous understory has a stable trend overall. Sum of nested frequency for perennial grasses increased while that of perennial forbs declined. Crested wheatgrass and Russian wildrye are the most abundant herbaceous species at the present time. Cheatgrass significantly declined in both cover and frequency in 2002 due to drought conditions. It would be expected to return to near equal abundance with normal precipitation patterns.

### TREND ASSESSMENT

soil - slightly up (4)

browse - N/A

herbaceous understory - stable (3)

### HERBACEOUS TRENDS --

Herd unit 19B, Study no: 19

Type	Species	Nested Frequency			Quadrat Frequency			Average Cover %		
		'98	'99	'02	'98	'99	'02	'98	'99	'02
G	Agropyron cristatum	<sub>a</sub> 58	<sub>b</sub> 74	93	25	34	40	1.64	2.61	7.23
G	Agropyron elongatum	7	7	9	3	3	4	.33	.19	.61
G	Agropyron spicatum	-	3	-	-	1	-	-	.00	-
G	Bromus inermis	-	-	-	-	-	-	.00	.03	-
G	Bromus japonicus (a)	-	-	4	-	-	2	-	-	.03
G	Bromus tectorum (a)	<sub>a</sub> 268	<sub>b</sub> 395	<sub>a</sub> 227	79	96	66	12.52	20.85	3.51
G	Elymus junceus	27	22	26	9	9	11	1.49	1.32	2.77
G	Oryzopsis hymenoides	<sub>ab</sub> 4	<sub>a</sub> 3	<sub>b</sub> 6	2	2	4	.21	.45	.74
G	Sitanion hystrix	<sub>ab</sub> 2	<sub>a</sub> -	<sub>b</sub> 9	1	-	3	.38	.00	.23
Total for Annual Grasses		268	395	231	79	96	68	12.52	20.85	3.54
Total for Perennial Grasses		98	109	143	40	49	62	4.06	4.62	11.60
Total for Grasses		366	504	374	119	145	130	16.58	25.48	15.14

T y p e	Species	Nested Frequency			Quadrat Frequency			Average Cover %		
		'98	'99	'02	'98	'99	'02	'98	'99	'02
F	Alyssum desertorum (a)	<sub>a</sub> 45	<sub>a</sub> 65	<sub>b</sub> 290	19	25	73	.26	.20	4.65
F	Argemone munita	-	-	-	-	-	-	.30	.03	-
F	Astragalus spp.	3	-	6	2	-	3	.01	-	.04
F	Camelina microcarpa (a)	-	8	-	-	3	-	-	.30	-
F	Carduus nutans (a)	2	-	-	1	-	-	.00	-	-
F	Chaenactis douglasii	<sub>b</sub> 11	<sub>a</sub> -	<sub>ab</sub> 3	5	-	1	.24	-	.00
F	Chenopodium spp. (a)	-	-	1	-	-	1	-	-	.00
F	Cruciferae	<sub>b</sub> 10	<sub>a</sub> -	<sub>a</sub> -	5	-	-	.24	-	-
F	Cryptantha spp.	-	-	5	-	-	2	-	-	.03
F	Descurainia pinnata (a)	8	-	-	3	-	-	.18	-	-
F	Eriogonum cernuum (a)	<sub>b</sub> 16	<sub>ab</sub> 8	<sub>a</sub> -	7	3	-	.23	.06	-
F	Gilia spp. (a)	-	2	1	-	1	1	-	.00	.00
F	Helianthus annuus (a)	-	2	-	-	1	-	-	.00	-
F	Lactuca serriola	<sub>b</sub> 68	<sub>b</sub> 86	<sub>a</sub> -	36	37	-	2.51	1.20	-
F	Lesquerella spp.	-	-	3	-	-	1	.00	-	.00
F	Machaeranthera canescens	-	-	1	-	-	1	-	-	.00
F	Nicotiana attenuata (a)	-	-	-	-	-	-	.00	-	-
F	Phlox hoodii	-	-	3	-	-	1	-	-	.00
F	Phlox longifolia	-	-	3	-	-	2	-	-	.01
F	Salsola iberica (a)	<sub>a</sub> 1	<sub>a</sub> 10	<sub>b</sub> 43	1	4	14	.01	.33	.78
F	Senecio multilobatus	-	-	5	-	-	2	-	-	.04
F	Sisymbrium altissimum (a)	<sub>a</sub> 4	<sub>a</sub> 22	<sub>b</sub> 86	2	12	25	.31	.49	2.20
Total for Annual Forbs		76	117	421	33	49	114	1.02	1.40	7.65
Total for Perennial Forbs		92	86	29	48	37	13	3.32	1.23	0.14
Total for Forbs		168	203	450	81	86	127	4.34	2.64	7.80

Values with different subscript letters are significantly different at alpha = 0.10

#### BROWSE TRENDS --

Herd unit 19B, Study no: 19

T y p e	Species	Strip Frequency			Average Cover %		
		'98	'99	'02	'98	'99	'02
B	Atriplex canescens	2	0	0	.03	-	-
Total for Browse		2	0	0	0.03	0	0

BASIC COVER --

Herd unit 19B, Study no: 19

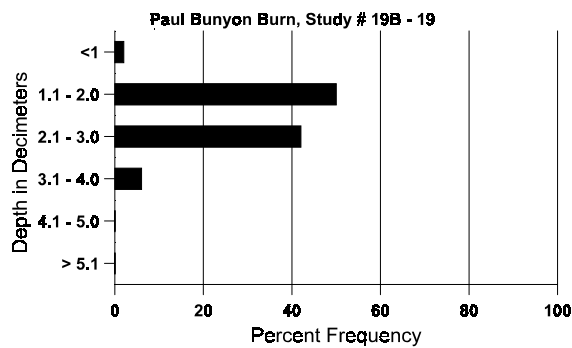
Cover Type	Nested Frequency			Average Cover %		
	'98	'99	'02	'98	'99	'02
Vegetation	312	426	428	21.67	30.56	24.22
Rock	182	145	96	3.33	3.46	2.35
Pavement	461	395	373	32.45	14.92	19.34
Litter	460	459	480	15.95	35.60	45.85
Cryptogams	-	-	5	0	0	.38
Bare Ground	415	371	372	39.84	28.43	23.67

SOIL ANALYSIS DATA --

Herd Unit 19B, Study no: 19, Paul Bunyon Burn

Effective rooting depth (in)	Temp °F (depth)	pH	%sand	%silt	%clay	%OM	PPM P	PPM K	ds/m
14.0	70.0 (15.5)	7.0	48.7	24.7	26.6	2.7	11.6	115.2	0.6

## Stoniness Index



PELLET GROUP FREQUENCY --

Herd unit 19B, Study no: 19

Type	Quadrat Frequency			Pellet Groups per Acre '02	Days Use per Acre (ha) '02
	'98	'99	'02		
Rabbit	11	13	22	-	-
Elk	-	4	-	-	-
Deer	1	3	6	96	7 (18)
Cattle	-	-	-	9	1 (2)



## BROWSE CHARACTERISTICS --

Herd unit 19B, Study no: 19

A G E	Y R	Form Class (No. of Plants)									Vigor Class				Plants Per Acre	Average (inches) Ht. Cr.	Total
		1	2	3	4	5	6	7	8	9	1	2	3	4			
Artemisia tridentata wyomingensis																	
X	98	-	-	-	-	-	-	-	-	-	-	-	-	-	20		1
	99	-	-	-	-	-	-	-	-	-	-	-	-	-	0		0
	02	-	-	-	-	-	-	-	-	-	-	-	-	-	0		0
% Plants Showing		<u>Moderate Use</u>			<u>Heavy Use</u>			<u>Poor Vigor</u>			<u>%Change</u>						
'98		00%			00%			00%									
'99		00%			00%			00%									
'02		00%			00%			00%									
Total Plants/Acre (excluding Dead & Seedlings)												'98	0	Dec:	-		
												'99	0		-		
												'02	0		-		
Atriplex canescens																	
Y	98	-	-	1	-	-	-	-	-	-	1	-	-	-	20		1
	99	-	-	-	-	-	-	-	-	-	-	-	-	-	0		0
	02	-	-	-	-	-	-	-	-	-	-	-	-	-	0		0
M	98	1	-	-	-	-	-	-	-	-	1	-	-	-	20	-	1
	99	-	-	-	-	-	-	-	-	-	-	-	-	-	0	-	0
	02	-	-	-	-	-	-	-	-	-	-	-	-	-	0	44 62	0
X	98	-	-	-	-	-	-	-	-	-	-	-	-	-	0		0
	99	-	-	-	-	-	-	-	-	-	-	-	-	-	20		1
	02	-	-	-	-	-	-	-	-	-	-	-	-	-	0		0
% Plants Showing		<u>Moderate Use</u>			<u>Heavy Use</u>			<u>Poor Vigor</u>			<u>%Change</u>						
'98		00%			50%			00%									
'99		00%			00%			00%									
'02		00%			00%			00%									
Total Plants/Acre (excluding Dead & Seedlings)												'98	40	Dec:	-		
												'99	0		-		
												'02	0		-		
Chrysothamnus nauseosus albicaulis																	
M	98	-	-	-	-	-	-	-	-	-	-	-	-	-	0	-	0
	99	-	-	-	-	-	-	-	-	-	-	-	-	-	0	-	0
	02	-	-	-	-	-	-	-	-	-	-	-	-	-	0	42 66	0
% Plants Showing		<u>Moderate Use</u>			<u>Heavy Use</u>			<u>Poor Vigor</u>			<u>%Change</u>						
'98		00%			00%			00%									
'99		00%			00%			00%									
'02		00%			00%			00%									
Total Plants/Acre (excluding Dead & Seedlings)												'98	0	Dec:	-		
												'99	0		-		
												'02	0		-		

A G R E	Y R	Form Class (No. of Plants)									Vigor Class				Plants Per Acre	Average (inches) Ht. Cr.		Total
		1	2	3	4	5	6	7	8	9	1	2	3	4				
Cowania mexicana stansburiana																		
M	'98	-	-	-	-	-	-	-	-	-	-	-	-	-	0	-	-	0
	'99	-	-	-	-	-	-	-	-	-	-	-	-	-	0	-	-	0
	'02	-	-	-	-	-	-	-	-	-	-	-	-	-	0	16	18	0
% Plants Showing		<u>Moderate Use</u>			<u>Heavy Use</u>			<u>Poor Vigor</u>			<u>%Change</u>							
		'98			00%			00%			00%							
		'99			00%			00%			00%							
		'02			00%			00%			00%							
Total Plants/Acre (excluding Dead & Seedlings)												'98	0	Dec:	-			
												'99	0		-			
												'02	0		-			
Ephedra viridis																		
M	'98	-	-	-	-	-	-	-	-	-	-	-	-	-	0	-	-	0
	'99	-	-	-	-	-	-	-	-	-	-	-	-	-	0	-	-	0
	'02	-	-	-	-	-	-	-	-	-	-	-	-	-	0	27	44	0
% Plants Showing		<u>Moderate Use</u>			<u>Heavy Use</u>			<u>Poor Vigor</u>			<u>%Change</u>							
		'98			00%			00%			00%							
		'99			00%			00%			00%							
		'02			00%			00%			00%							
Total Plants/Acre (excluding Dead & Seedlings)												'98	0	Dec:	-			
												'99	0		-			
												'02	0		-			
Juniperus osteosperma																		
X	'98	-	-	-	-	-	-	-	-	-	-	-	-	-	380			19
	'99	-	-	-	-	-	-	-	-	-	-	-	-	-	340			17
	'02	-	-	-	-	-	-	-	-	-	-	-	-	-	0			0
% Plants Showing		<u>Moderate Use</u>			<u>Heavy Use</u>			<u>Poor Vigor</u>			<u>%Change</u>							
		'98			00%			00%			00%							
		'99			00%			00%			00%							
		'02			00%			00%			00%							
Total Plants/Acre (excluding Dead & Seedlings)												'98	0	Dec:	-			
												'99	0		-			
												'02	0		-			
Purshia tridentata																		
M	'98	-	-	-	-	-	-	-	-	-	-	-	-	-	0	-	-	0
	'99	-	-	-	-	-	-	-	-	-	-	-	-	-	0	-	-	0
	'02	-	-	-	-	-	-	-	-	-	-	-	-	-	0	13	22	0
% Plants Showing		<u>Moderate Use</u>			<u>Heavy Use</u>			<u>Poor Vigor</u>			<u>%Change</u>							
		'98			00%			00%			00%							
		'99			00%			00%			00%							
		'02			00%			00%			00%							
Total Plants/Acre (excluding Dead & Seedlings)												'98	0	Dec:	-			
												'99	0		-			
												'02	0		-			

Trend Study 19B-20-02

Study site name: Paul Bunyan Burn and Chain.

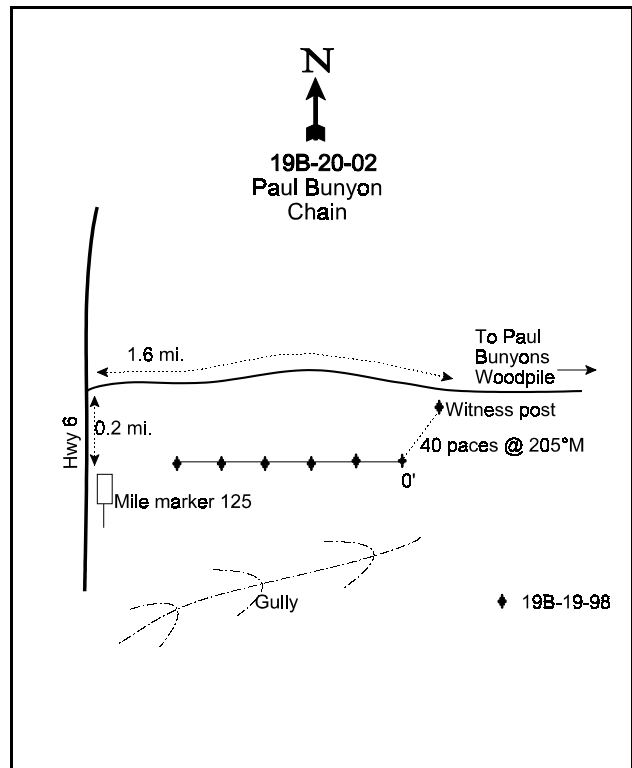
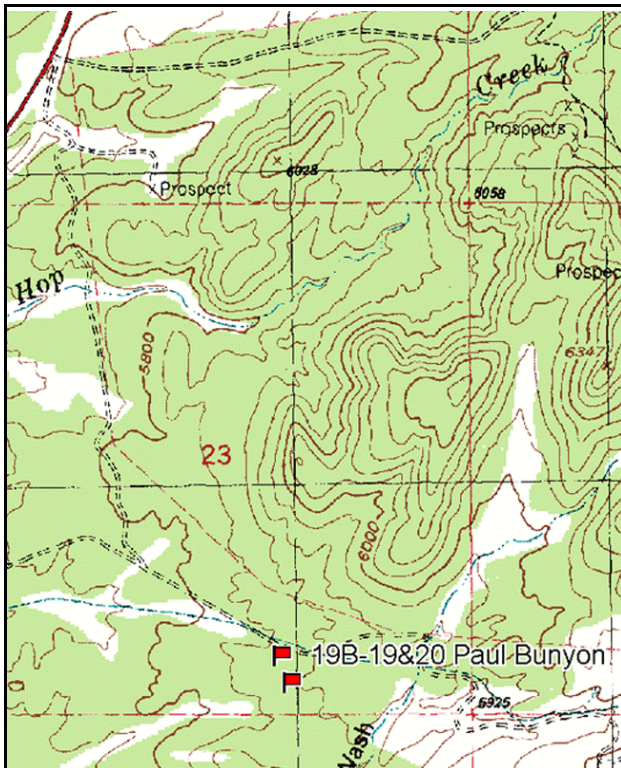
Vegetation type: Burn and Seeded.

Compass bearing: frequency baseline 268 degrees magnetic.

Frequency belt placement: line 1 (11ft), line 2 (34ft), line 3 (59ft), line 4 (71ft), line 5 (95ft).

LOCATION DESCRIPTION

From Hwy 6 go 0.2 miles north of mile marker 125. Turn right heading toward the Paul Bunyan Woodpile. Drive 1.6 miles to a four foot tall witness post on the right side of the road. The 0-foot stake for this study is 40 paces at 205 degrees magnetic from the witness post. The site is marked by short green fenceposts. The 0-foot stake is marked by browse tag #74.



Map Name: McIntyre

Diagrammatic Sketch

Township 12S, Range 3W, Section 23

GPS: NAD 27, UTM 12S 4401419 N 401929 E

## DISCUSSION

### Paul Bunyan Burn and Chain - Trend Study No. 19B-20

This study was placed northwest of the Paul Bunyan Burn site (19B-19). Seed was aerially applied and then this site was chained one-way with an Ely chain to help cover the seed and enhance establishment of seeded species. It has a western aspect with a gentle 5% slope. Elevation is approximately 5,900 feet. A pellet group transect read on site in 1999 found no deer sign but rabbit pellets were found in moderately high numbers. Pellet group transect data collected in 2002 again sampled no deer or elk pellet groups. Due to the lack of browse throughout the area, this site is of very little use for wintering big game.

Soil on this site is very similar to the adjacent Paul Bunyan Burn site (19B-19). Effective rooting depth is estimated at 14 inches. Soil texture is a sandy clay loam with a neutral pH (7.0). Percent phosphorus is lower at just 8.9 ppm which may be limiting to plant development for values less than 10ppm can limit plant growth and development. In 1998, ground cover characteristics were similar to those on the burned only site, except pavement cover which was lower and bare ground that was higher. In 2002, vegetation and bare ground remained stable compared to the 1999 data, while litter cover increased. There is little sign of erosion on the site. The erosion condition class was determined as stable in 2002.

Seeded fourwing saltbush was applied with a seed dribbler which dropped seed over the tracks of the bulldozers as they pulled the chain over the site. Density of fourwing saltbush was estimated at 280 plants/acre in 1998, 240 plants/acre in 1999, and 160 plants/acre in 2002. The decline in density is due to the loss of the young age class in 2002. Fourwing plants were vigorous in 1998, but with drought in 2002, poor vigor was displayed by 63% of the remaining population and decadence was high at 63%. Other palatable browse on the site include a few scattered plants of green ephedra, white-stemmed rubber rabbitbrush, Stansbury cliffrose, and bitterbrush.

The herbaceous understory was much quicker to develop on this site compared to the burn and unchained site. Crested wheatgrass, Russian wildrye, and tall wheatgrass were all represented well in the first reading in 1998. Cheatgrass brome was also abundant during the initial reading with the highest nested frequency value of any species. Crested wheatgrass and tall wheatgrass have remained at stable frequencies since 1998, but Russian wildrye has significantly decreased with the drought. Cheatgrass was stable in nested frequency between 1998 and 1999, but with drought in 2002, significantly declined. Cheatgrass cover also declined in 2002. Native perennial grasses have been rare in all samples. In 2002, crested wheatgrass, tall wheatgrass, and Russian wildrye accounted for 83% of the total grass cover on the site. Forbs are lacking on the chained site as was the case with the unchained site. In 1998, total forb cover was actually higher on the unchained site, but composition was similar and only prickly lettuce and tumble mustard were common. In 2002, sum of nested frequency for perennial forbs declined.

### 1998 APPARENT TREND ASSESSMENT

Percent bare ground is abundant, but significant erosion does not appear to be occurring. Vegetation cover is well dispersed and consists mostly of perennial grasses. The soil trend will improve as more herbaceous vegetation becomes established. The seeded fourwing saltbush has established well with a density of 280 plants/acre. These are vigorous and age class composition indicates an expanding population with young plants accounting for half of the population. The herbaceous understory is well established and will most likely increase in the future. Perennial seeded grasses are abundant and robust. Native grasses are also present in small numbers. Cheatgrass has similar nested frequency values compared to the unchained site, but cover is one-third lower (12.5% vs 4.4%). The vigorous perennial grasses appear to be suppressing cheatgrass. Forbs are infrequent with a similar poor composition compared to the unchained site. Composition will likely change in the future with some of the weedy species dying out. However, there will probably never be a good forb component due to the lack of an adequate seed bank. Forbs were not included in the seeding mix because of the possibility of future spraying to kill noxious weeds.

## 2002 TREND ASSESSMENT

Trend for soil is stable. Ground cover estimates are similar to the 1999 levels. Litter cover slightly increased in 2002. Erosion remains minimal and the erosion condition class was determined as stable. Trend for browse is down. Fourwing saltbush seemed to have established quite well in 1998, but density has decreased with the loss of the young age class in 2002. Poor vigor and decadence are high as well at 63%. It appears that the browse component will be minimal and provide very little winter forage for big game in the future. The herbaceous understory has a stable trend. Perennial grasses are maintaining themselves on the site, and cheatgrass has significantly decreased in nested frequency. Forbs remain sparse and unimportant.

### TREND ASSESSMENT

soil - stable (3)

browse - down (1)

herbaceous understory - stable (3)

### HERBACEOUS TRENDS --

Herd unit 19B, Study no: 20

Type	Species	Nested Frequency			Quadrat Frequency			Average Cover %		
		'98	'99	'02	'98	'99	'02	'98	'99	'02
G	Agropyron cristatum	133	139	158	52	53	60	7.22	8.46	12.64
G	Agropyron elongatum	52	44	47	24	22	18	2.69	2.12	2.34
G	Agropyron spicatum	9	13	14	3	6	4	.56	.78	1.44
G	Bromus tectorum (a)	<sub>b</sub> 270	<sub>b</sub> 265	<sub>a</sub> 124	84	76	43	4.39	5.38	2.13
G	Elymus junceus	<sub>b</sub> 78	<sub>a</sub> 24	<sub>a</sub> 33	32	11	18	3.87	.45	3.65
G	Oryzopsis hymenoides	-	-	2	-	-	1	-	-	.06
G	Poa secunda	-	7	-	-	4	-	-	.02	-
G	Sitanion hystrix	4	4	-	3	1	-	.21	.01	.00
Total for Annual Grasses		270	265	124	84	76	43	4.39	5.38	2.13
Total for Perennial Grasses		276	231	254	114	97	101	14.56	11.86	20.16
Total for Grasses		546	496	378	198	173	144	18.95	17.24	22.29
F	Alyssum desertorum (a)	<sub>a</sub> 13	<sub>a</sub> 27	<sub>b</sub> 122	5	10	38	.19	.10	.38
F	Antennaria rosea	-	-	3	-	-	1	-	-	.00
F	Astragalus calycosus	10	6	7	4	4	3	.09	.04	.04
F	Calochortus nuttallii	2	-	-	1	-	-	.00	-	-
F	Chaenactis douglasii	4	-	1	2	-	1	.03	-	.00
F	Cryptantha spp.	3	7	-	1	2	-	.00	.01	-
F	Gilia spp. (a)	3	1	-	1	1	-	.00	.00	-
F	Lactuca serriola	<sub>b</sub> 35	<sub>b</sub> 49	<sub>a</sub> 11	19	18	4	.58	.36	.19
F	Lesquerella spp.	1	-	1	1	-	1	.01	-	.00
F	Lomatium spp.	3	-	-	1	-	-	.03	-	-
F	Phlox hoodii	2	-	2	1	-	1	.00	-	.15
F	Phlox longifolia	<sub>a</sub> -	<sub>a</sub> -	<sub>b</sub> 11	-	-	5	-	-	.02
F	Salsola iberica (a)	<sub>a</sub> 1	<sub>ab</sub> 14	<sub>b</sub> 21	1	7	9	.03	.09	.22
F	Sisymbrium altissimum (a)	<sub>b</sub> 20	<sub>a</sub> 2	<sub>a</sub> -	12	1	-	.32	.07	-
F	Streptanthus cordatus	9	-	1	3	-	1	.06	-	.01

T y p e	Species	Nested Frequency			Quadrat Frequency			Average Cover %		
		'98	'99	'02	'98	'99	'02	'98	'99	'02
	Total for Annual Forbs	37	44	143	19	19	47	0.55	0.27	0.60
	Total for Perennial Forbs	69	62	37	33	24	17	0.83	0.41	0.42
	Total for Forbs	106	106	180	52	43	64	1.38	0.68	1.03

Values with different subscript letters are significantly different at alpha = 0.10

#### BROWSE TRENDS --

Herd unit 19B, Study no: 20

T y p e	Species	Strip Frequency			Average Cover %		
		'98	'99	'02	'98	'99	'02
B	Atriplex canescens	14	11	8	.63	.73	.48
B	Chrysothamnus viscidiflorus viscidiflorus	1	0	1	-	-	-
B	Ephedra viridis	0	1	0	-	-	-
	Total for Browse	15	12	9	0.63	0.73	0.48

#### BASIC COVER --

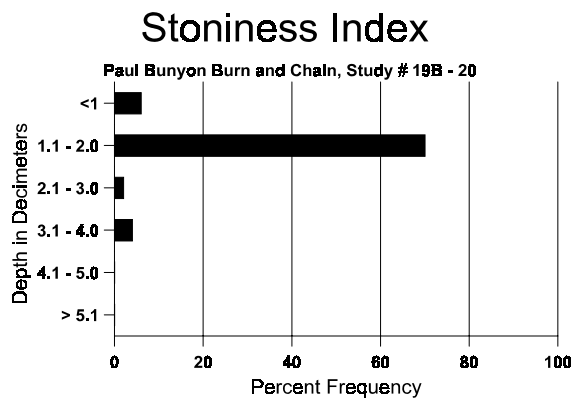
Herd unit 19B, Study no: 20

Cover Type	Nested Frequency			Average Cover %		
	'98	'99	'02	'98	'99	'02
Vegetation	345	359	338	21.46	24.41	24.92
Rock	207	167	160	4.19	4.36	3.43
Pavement	446	423	394	17.03	16.23	20.65
Litter	465	463	472	13.75	26.82	37.07
Bare Ground	469	401	381	49.65	32.64	30.29

#### SOIL ANALYSIS DATA --

Herd Unit 19B, Study no: 20, Paul Bunyon Burn and Chain

Effective rooting depth (inches)	Temp °F (depth)	pH	%sand	%silt	%clay	%0M	PPM P	PPM K	ds/m
13.9	69.0 (14.5)	7.0	48.4	25.1	26.6	2.7	8.9	134.4	0.6



#### PELLET GROUP FREQUENCY --

Herd unit 19B, Study no: 20

Type	Quadrat Frequency			Pellet Groups per Acre '02	Days Use per Acre (ha) '02
	'98	'99	'02		
Rabbit	3	8	13	-	-
Horse	-	-	1	-	-
Elk	-	8	-	-	-
Deer	-	-	3	-	-

#### BROWSE CHARACTERISTICS --

Herd unit 19B, Study no: 20

A Y G R E		Form Class (No. of Plants)									Vigor Class				Plants Per Acre	Average (inches) Ht. Cr.	Total
		1	2	3	4	5	6	7	8	9	1	2	3	4			
Artemisia tridentata wyomingensis																	
X	98	-	-	-	-	-	-	-	-	-	-	-	-	-	120		6
	99	-	-	-	-	-	-	-	-	-	-	-	-	-	0		0
	02	-	-	-	-	-	-	-	-	-	-	-	-	-	0		0
% Plants Showing		<u>Moderate Use</u>			<u>Heavy Use</u>			<u>Poor Vigor</u>			<u>%Change</u>						
'98		00%			00%			00%									
'99		00%			00%			00%									
'02		00%			00%			00%									
Total Plants/Acre (excluding Dead & Seedlings)														'98	0	Dec:	-
														'99	0		-
														'02	0		-

A G E	Y R	Form Class (No. of Plants)									Vigor Class				Plants Per Acre	Average (inches) Ht. Cr.		Total
		1	2	3	4	5	6	7	8	9	1	2	3	4				
Atriplex canescens																		
S	98	1	-	-	-	-	-	-	-	-	1	-	-	-	20		1	
	99	-	-	-	1	-	-	-	-	-	1	-	-	-	20		1	
	02	-	-	-	-	-	-	-	-	-	-	-	-	-	0		0	
Y	98	7	-	-	-	-	-	-	-	-	7	-	-	-	140		7	
	99	3	-	-	-	-	-	-	-	-	3	-	-	-	60		3	
	02	-	-	-	-	-	-	-	-	-	-	-	-	-	0		0	
M	98	7	-	-	-	-	-	-	-	-	7	-	-	-	140	31	35	
	99	8	-	-	-	-	-	-	-	-	8	-	-	-	160	28	31	
	02	2	1	-	-	-	-	-	-	-	3	-	-	-	60	36	43	
D	98	-	-	-	-	-	-	-	-	-	-	-	-	-	0		0	
	99	1	-	-	-	-	-	-	-	-	1	-	-	-	20		1	
	02	5	-	-	-	-	-	-	-	-	-	-	-	5	100		5	
X	98	-	-	-	-	-	-	-	-	-	-	-	-	-	0		0	
	99	-	-	-	-	-	-	-	-	-	-	-	-	-	0		0	
	02	-	-	-	-	-	-	-	-	-	-	-	-	-	40		2	
% Plants Showing		<u>Moderate Use</u>			<u>Heavy Use</u>			<u>Poor Vigor</u>			<u>%Change</u>							
'98		00%			00%			00%			-14%							
'99		00%			00%			00%			-33%							
'02		13%			00%			63%										
Total Plants/Acre (excluding Dead & Seedlings)												'98	280	Dec:	0%			
												'99	240		8%			
												'02	160		63%			
Chrysothamnus nauseosus albicaulis																		
M	98	-	-	-	-	-	-	-	-	-	-	-	-	-	0	-	-	
	99	-	-	-	-	-	-	-	-	-	-	-	-	-	0	-	-	
	02	-	-	-	-	-	-	-	-	-	-	-	-	-	0	33	60	
% Plants Showing		<u>Moderate Use</u>			<u>Heavy Use</u>			<u>Poor Vigor</u>			<u>%Change</u>							
'98		00%			00%			00%										
'99		00%			00%			00%										
'02		00%			00%			00%										
Total Plants/Acre (excluding Dead & Seedlings)												'98	0	Dec:	-			
												'99	0		-			
												'02	0		-			
Chrysothamnus viscidiflorus viscidiflorus																		
M	98	1	-	-	-	-	-	-	-	-	1	-	-	-	20	-	-	
	99	-	-	-	-	-	-	-	-	-	-	-	-	-	0	-	-	
	02	1	-	-	-	-	-	-	-	-	1	-	-	-	20	16	31	
% Plants Showing		<u>Moderate Use</u>			<u>Heavy Use</u>			<u>Poor Vigor</u>			<u>%Change</u>							
'98		00%			00%			00%										
'99		00%			00%			00%										
'02		00%			00%			00%										
Total Plants/Acre (excluding Dead & Seedlings)												'98	20	Dec:	-			
												'99	0		-			
												'02	20		-			



A G E	Y R	Form Class (No. of Plants)									Vigor Class				Plants Per Acre	Average (inches) Ht. Cr.		Total
		1	2	3	4	5	6	7	8	9	1	2	3	4				
Cowania mexicana stansburiana																		
M	98	-	-	-	-	-	-	-	-	-	-	-	-	-	0	-	-	0
	99	-	-	-	-	-	-	-	-	-	-	-	-	-	0	-	-	0
	02	-	-	-	-	-	-	-	-	-	-	-	-	-	0	30	33	0
% Plants Showing		<u>Moderate Use</u>			<u>Heavy Use</u>			<u>Poor Vigor</u>			<u>%Change</u>							
'98		00%			00%			00%										
'99		00%			00%			00%										
'02		00%			00%			00%										
Total Plants/Acre (excluding Dead & Seedlings)												'98	0	Dec:	-			
												'99	0		-			
												'02	0		-			
Ephedra viridis																		
Y	98	-	-	-	-	-	-	-	-	-	-	-	-	-	0			0
	99	1	-	-	-	-	-	-	-	-	-	1	-	-	20			1
	02	-	-	-	-	-	-	-	-	-	-	-	-	-	0			0
M	98	-	-	-	-	-	-	-	-	-	-	-	-	-	0	-	-	0
	99	-	-	-	-	-	-	-	-	-	-	-	-	-	0	-	-	0
	02	-	-	-	-	-	-	-	-	-	-	-	-	-	0	22	30	0
% Plants Showing		<u>Moderate Use</u>			<u>Heavy Use</u>			<u>Poor Vigor</u>			<u>%Change</u>							
'98		00%			00%			00%										
'99		00%			00%			00%										
'02		00%			00%			00%										
Total Plants/Acre (excluding Dead & Seedlings)												'98	0	Dec:	-			
												'99	20		-			
												'02	0		-			
Juniperus osteosperma																		
X	98	-	-	-	-	-	-	-	-	-	-	-	-	-	360			18
	99	-	-	-	-	-	-	-	-	-	-	-	-	-	220			11
	02	-	-	-	-	-	-	-	-	-	-	-	-	-	0			0
% Plants Showing		<u>Moderate Use</u>			<u>Heavy Use</u>			<u>Poor Vigor</u>			<u>%Change</u>							
'98		00%			00%			00%										
'99		00%			00%			00%										
'02		00%			00%			00%										
Total Plants/Acre (excluding Dead & Seedlings)												'98	0	Dec:	-			
												'99	0		-			
												'02	0		-			
Purshia tridentata																		
M	98	-	-	-	-	-	-	-	-	-	-	-	-	-	0	-	-	0
	99	-	-	-	-	-	-	-	-	-	-	-	-	-	0	17	25	0
	02	-	-	-	-	-	-	-	-	-	-	-	-	-	0	21	28	0
% Plants Showing		<u>Moderate Use</u>			<u>Heavy Use</u>			<u>Poor Vigor</u>			<u>%Change</u>							
'98		00%			00%			00%										
'99		00%			00%			00%										
'02		00%			00%			00%										
Total Plants/Acre (excluding Dead & Seedlings)												'98	0	Dec:	-			
												'99	0		-			
												'02	0		-			

## Summary and Comparison of Paul Bunyan Burn (19B-19) and Paul Bunyan Burn & Chain (19B-20)

Studies 19B-19 and 19B-20 were established in 1998 to monitor the recovery of the vegetation community on two treatments following a wildfire. Both of these studies were aerially seeded, with study 19B-20 being one-way chained following the seeding with an Ely chain. These studies were paired to compare differences in restoration efforts between seeding only (19B-19) and seeding followed by one-way chaining (19B-20) to cover the seed and enhance establishment of the seeded species. Both sites were seeded with the same seed mix.

The most important comparisons that can be made between these sites is with the establishment and persistence of the herbaceous species since the treatments. Grasses have developed into the major component of the vegetation community on these studies. During the initial reading in 1998, perennial grasses were more abundant in sum of nested frequency and average cover on the seeded and chained site compared to the unchained site (Figures 1 and 2).

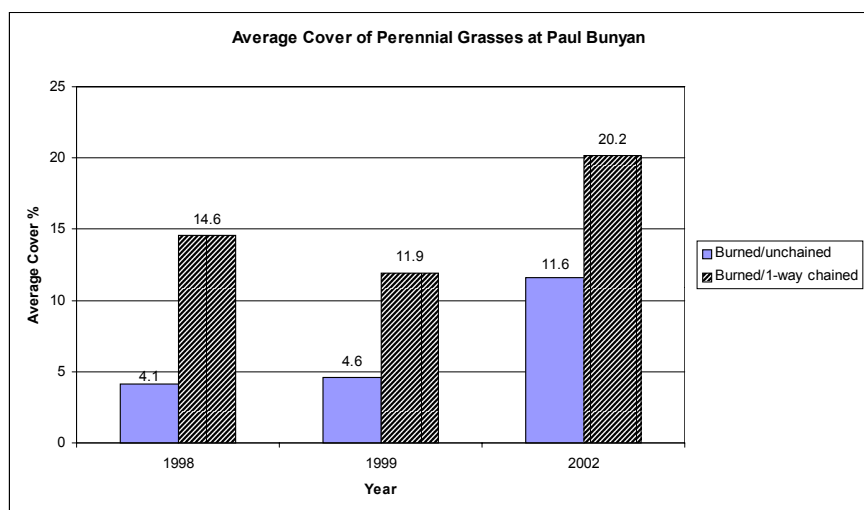


Figure 1. A comparison of percent cover values for perennial grasses from 1998-2002 on the Paul Bunyan fire rehabilitation studies.

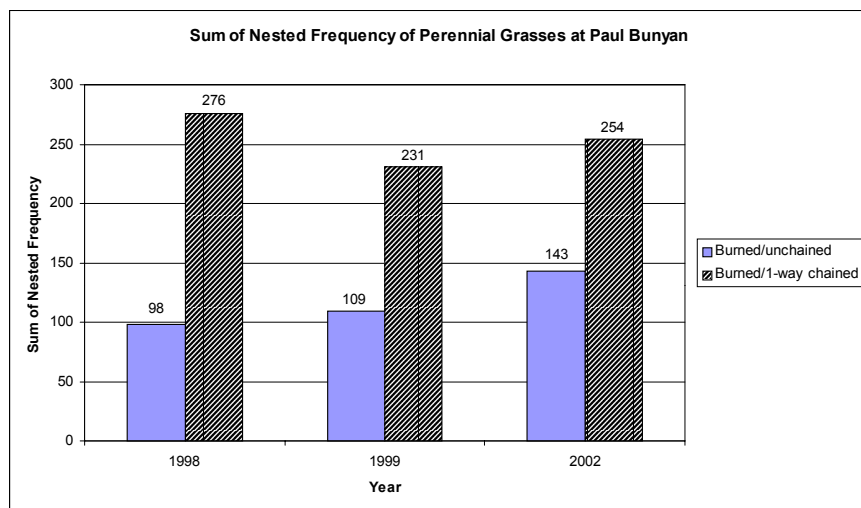


Figure 2. A comparison of sum of nested frequency values for perennial grasses from 1998-2002 on the Paul Bunyan fire rehabilitation studies.

During the first reading, perennial grasses provided more than three times the amount of cover on the site that was seeded and one-way chained. Sum of nested frequency for all perennial grasses combined was nearly three times higher on the chained site as well. In 2002, five years after the treatments were conducted, perennial grasses still provide nearly twice the amount of cover and sum of nested frequency on the site that was seeded and chained compared to the site that was only seeded.

Cheatgrass provided more average cover on the unchained site in 1998, although nested frequency was nearly identical between the two treatments (Figures 3 and 4). In 1999 and 2002, cheatgrass cover and nested frequency was higher on the unchained site. The abundance of cheatgrass on both sites was less in 2002 due to continuing drought conditions.

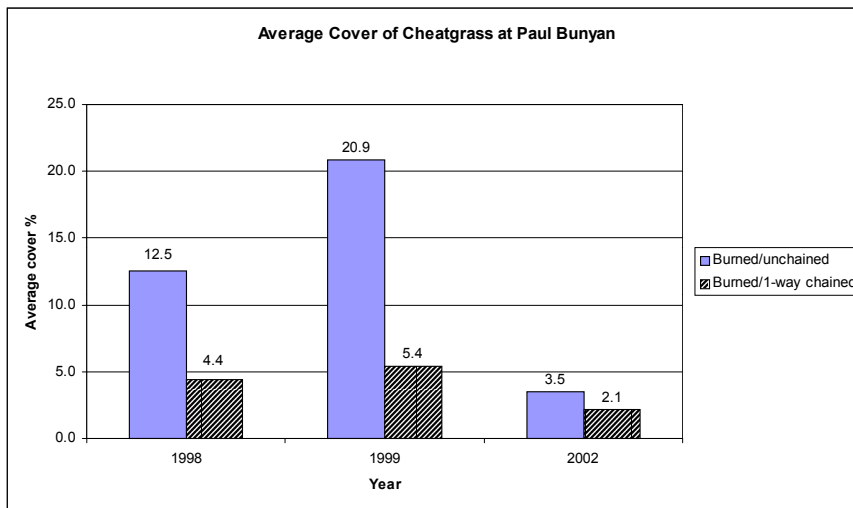


Figure 3. A comparison of percent cover values for cheatgrass from 1998-2002 on the Paul Bunyan fire rehabilitation studies.

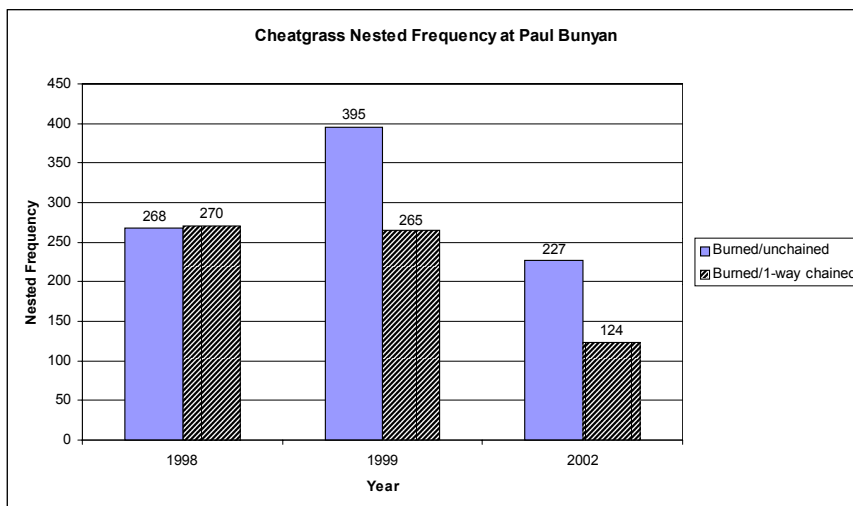


Figure 4. A comparison of cheatgrass nested frequency values from 1998-2002 on the Paul Bunyan fire rehabilitation studies.

The best way to control cheatgrass abundance is to have a healthy and abundant perennial understory. The data from these studies is consistent with this idea. There was less cheatgrass on the chained and seeded site, both initially and five years following treatment. Perennial grasses established better where the chain was used to prepare the seedbed compared to seeding the site and doing nothing to prepare the seedbed.

Both the forb and browse components are sparse and relatively unimportant on these sites. Forbs were not included in the seed mix because of the threat of noxious weed invasion and the possibility of needing to use herbicides following treatment. The browse component was dominated by juniper prior to the burn resulting in a depleted native seedbank of herbaceous and shrub species. Most of the vegetative community at the present time is made up of non-native seeded species which will likely continue in the future. These sites have very little use for wildlife due to the minimal amount of palatable browse for winter forage.